Vulnerable Road Users

Definition of Vulnerable Road Users

Road users who have the potential for a disproportionately high casualty rate and who should, therefore, be given special attention in road safety policy are often referred to as vulnerable road users. The most common conditions prompting the designation of a road user as vulnerable are the amount of protection afforded them in traffic (e.g., pedestrians and cyclists) and their general task capability (e.g., the young, elderly, or disabled).

Protection

The lack of external protection is a primary gauge for designating a road user as vulnerable. Most vulnerable road users are those without a vehicle (and, thus, without a protective "shell")—e.g., pedestrians. Those using a vehicle without a shell—e.g., cyclists—are also in this group. These users also face a considerable mass disadvantage compared to larger vehicles.

Task Capability

Vulnerable road users may also display a low task capability (in this case, the ability to safely and effectively use the roadway and/or its surrounding environment), but are not a direct threat to others. Children, especially the very young, may lack the knowledge or experience to appreciate the sheer power that automobiles possess. Meanwhile, the elderly and the disabled may suffer from sensory limitations, physical fragility, and/or decreased mobility. From the age of fifty, for example, the bones get more brittle, and muscle strength and the elasticity of soft tissue declines; in a crash with equal collision energy, these age-related changes result in the elderly being more severely injured than the young.1

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Statistics

The following statistics are from the most recent year for which data are available:

Road User Type

<table>
<thead>
<tr>
<th>Road User Type</th>
<th>USA 2012</th>
<th>Florida 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatalities</td>
<td>% of Total Fatalities</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>4,743</td>
<td>14.1</td>
</tr>
<tr>
<td>Bicyclists</td>
<td>726</td>
<td>2.2</td>
</tr>
<tr>
<td>Motorcyclists</td>
<td>4,957</td>
<td>14.8</td>
</tr>
</tbody>
</table>

These figures clearly illustrate that vulnerable road users are significantly more likely to be killed in Florida than they are nationally. Indeed, Florida had the highest rate (6.32) in the nation of bicyclist fatalities per million population in 2012—nearly three times the national average (2.31). Take great care when encountering these users on the roadway!2

Age Group

<table>
<thead>
<tr>
<th>Age</th>
<th>USA 2012</th>
<th>% of Total Fatalities</th>
<th>Florida 2012</th>
<th>% of Total Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5</td>
<td>405</td>
<td>1.2</td>
<td>12</td>
<td>0.5</td>
</tr>
<tr>
<td>5 – 9</td>
<td>345</td>
<td>1.0</td>
<td>15</td>
<td>0.6</td>
</tr>
<tr>
<td>10 – 15</td>
<td>613</td>
<td>1.8</td>
<td>39</td>
<td>1.6</td>
</tr>
<tr>
<td>16 – 20</td>
<td>3,224</td>
<td>9.6</td>
<td>207</td>
<td>8.5</td>
</tr>
<tr>
<td>21 – 24</td>
<td>3,436</td>
<td>10.2</td>
<td>239</td>
<td>9.9</td>
</tr>
<tr>
<td>25 – 34</td>
<td>5,902</td>
<td>17.6</td>
<td>408</td>
<td>16.8</td>
</tr>
<tr>
<td>35 – 44</td>
<td>4,534</td>
<td>13.5</td>
<td>301</td>
<td>12.4</td>
</tr>
<tr>
<td>45 – 54</td>
<td>5,184</td>
<td>15.4</td>
<td>414</td>
<td>17.1</td>
</tr>
<tr>
<td>55 – 64</td>
<td>4,297</td>
<td>12.8</td>
<td>335</td>
<td>13.8</td>
</tr>
<tr>
<td>65 – 74</td>
<td>2,692</td>
<td>8.0</td>
<td>198</td>
<td>8.2</td>
</tr>
<tr>
<td>&gt; 74</td>
<td>2,868</td>
<td>8.5</td>
<td>252</td>
<td>10.4</td>
</tr>
<tr>
<td>Unknown</td>
<td>61</td>
<td>0.2</td>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>33,561</td>
<td>—</td>
<td>2,424</td>
<td>—</td>
</tr>
</tbody>
</table>

Older pedestrians (age 65+) accounted for 20% (935) of all pedestrian fatalities and an estimated 9% (7,000) of all pedestrians injured nationally in 2012; they made up only 14% of the total population. The fatality rate for older pedestrians was 2.17 per 100,000 population—higher than the rate for all other ages under 65, though pedestrian fatality rates start to rise from around age 45.³

**Interacting with Vulnerable Road Users**

The safety of vulnerable road users is generally enhanced by limiting the driving speed of motor vehicles and by separating unequal road-user types as much as possible. In a practical sense, this means that drivers should be watchful for vulnerable road users, slow down when operating a motor vehicle near them, and give them a generous space cushion.

**Pedestrians**

Pedestrians are, arguably, the most vulnerable of roadway users because they lack the protection of a vehicle surrounding them. It is every driver’s responsibility, therefore, to do everything possible to avoid colliding with a pedestrian. When driving in residential and business areas, drivers should anticipate the presence of pedestrians and drive slowly and cautiously. In residential areas, children may dart into the road. In business areas, people may wander into the street from between parked vehicles, and cross in the middle of the block or at intersections against the traffic signal.

Drivers who come to a stop for a traffic control device must stop before entering the crosswalk and remain stopped to allow any pedestrians in the crosswalk to cross the roadway. At uncontrolled intersections (intersections that lack traffic signs, signals, or pavement markings), drivers must yield the right-of-way, slowing down or stopping as necessary, to allow a pedestrian in a crosswalk—whether marked or unmarked—to cross the roadway. When a vehicle is stopped at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway, drivers of other vehicles approaching from the rear may not overtake and pass the stopped vehicle.

Drivers should take even more care when a blind or mobility-impaired pedestrian is crossing. Whenever a blind pedestrian guided by a dog or carrying a white cane (or a white cane with a red tip) is crossing the street, vehicle traffic must stop and allow the pedestrian to cross, taking such precautions as may be necessary to avoid injuring the pedestrian. Vehicles are to respond similarly to a mobility-impaired pedestrian who is in the process of crossing.

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For their part, pedestrians may not suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close that it is impossible for the driver to yield, and pedestrians crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection must yield the right-of-way to all vehicles upon the roadway. Between adjacent controlled intersections, pedestrians may not cross at any place except in a marked crosswalk. Pedestrians should not cross a roadway at any other place than by a route at right angles to the curb or by the shortest route to the opposite curb, unless they are in a marked crosswalk; pedestrians may not cross intersections diagonally, unless that crossing is authorized by traffic controls. Pedestrians are required to obey traffic signals or, where they are present, pedestrian signals.

Where sidewalks are provided, pedestrians may not walk on or along the portion of a roadway paved for vehicular traffic, unless required by other conditions. Where sidewalks are not provided, pedestrians may walk on the road, but must walk on the shoulder on the left side of the roadway in relation to the pedestrian’s direction of travel, facing traffic which may approach from the opposite direction.4

Bicyclists

It is imperative that you, as a responsible driver, pay special attention when driving near bicyclists as well. Every individual operating a bicycle on the roadways has the same rights and duties as an operator of a motor vehicle. In other words, cyclists are to obey the same traffic laws as drivers (in addition to bicycle-specific laws)—but many do not. However, anyone riding a bicycle on a sidewalk or in crosswalk has all the rights and duties applicable to a pedestrian under the same circumstances, though the bicyclist must yield the right-of-way to pedestrians and must give an audible warning before overtaking and passing a pedestrian.

Follow these safety tips when driving near bicyclists:

- It is the responsibility of any driver to ensure the safety of any bicyclist riding near the motor vehicle being operated.
- Always give bicyclists plenty of space to maneuver—at least three feet.
  
  - Never tailgate a bicyclist.
  
  - When passing a bicyclist, reduce your vehicle speed and give the rider a wide berth.
  
  - Be especially careful when approaching from behind a bicyclist who is wearing headphones, as they may neither see nor hear your vehicle.
  
  - Check your vehicle mirrors and blind spots often for bicyclists approaching from the rear of your vehicle, especially before making a right turn.
  
  - When making a right turn on a red traffic signal, anticipate a bicyclist riding on the wrong side of the road or on the sidewalk.

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FS 316.130.
FS 316.1301, 316.1303.
• Anticipate children on bicycles on residential streets and near parks, recreational areas, and schools.
• Before exiting a parked vehicle, check the vehicle’s left side mirror for bicyclists approaching from the rear.

A person operating a bicycle must ride on a permanent, regular seat, and all bicycle riders or passengers who are under 16 years of age must wear an approved bicycle helmet that is properly fitted and securely fastened. A bicycle may not be used to carry more persons at one time than the number for which it is designed or equipped (except that an adult rider may carry a child securely attached in a backpack or sling). Except as provided previously, a bicycle rider must carry any passenger who is a child under 4 years of age, or who weighs 40 pounds or less, in an appropriately sized protective seat or carrier, and that passenger may not be allowed to remain in the child seat or carrier when the rider is not in immediate control of the bicycle. Bicycle operators are required to keep at least one hand on the handlebars at all times, and may attach neither the bike nor themselves to any vehicle upon a roadway (i.e., "catch a ride").

Persons riding bicycles on a roadway may not ride more than two abreast except on paths or parts of roadways set aside for the exclusive use of bicycles. Bicyclists riding at less than the normal speed of traffic should ride in a lane marked for bicycle use or as close as practicable to the right-hand curb or edge of the roadway (or on the left on a one-way highway with two or more marked traffic lanes). Bicyclists may move from the right-hand edge of the roadway when...

• overtaking and passing another bicycle or vehicle proceeding in the same direction.
• preparing for a left turn at an intersection or into a private road or driveway.
• reasonably necessary to avoid a roadway hazard.

Bicycles are to be equipped with a braking system which will enable the rider to stop the bicycle within 25 feet from a speed of 10 mph on clean, dry, level pavement. Further, bicycles in use between sunset and sunrise must be equipped with a lamp on the front that shines a white light visible from a distance of at least 500 feet to the front, and a lamp and reflector on the rear each exhibiting a red light visible from a distance of 600 feet to the rear; additional reflectors are permitted—and, in fact, encouraged!5

Motorcycles

Motorcycle operators are at an increased risk for injury and death because they can be thrown from the vehicle and because, like pedestrians and bicyclists, they have no protection. Worse still, motorcycles—because of their size, quickness, and maneuverability—are more difficult to locate and track than larger vehicles. This is one reason why it is extremely important to constantly scan the roadway when driving. When turning, double-check to be sure that you will

not cross paths with an undetected motorcycle. And before changing lanes, always check your vehicle's blind spots to ensure there is not a motorcycle in the next lane.

Never tailgate a motorcycle. Motorcycles can normally stop more quickly than other vehicles. Also, a motorcycle rider may fall due to debris in the road or other hazards. Always drive in such a way as to protect the motorcyclist.

A person operating a motorcycle must ride on a permanent, regular seat, and a motorcycle may not be used to carry more persons at one time than the number for which it is designed or equipped. Motorcycle operators may not carry any article which prevents them from keeping both hands on the handlebars, and no passenger may ride in a position that will interfere with the operation or control of the motorcycle or the view of the operator. Handlebars or handgrips must be no higher than the top of the shoulders of the person operating the motorcycle, while properly seated upon the motorcycle; motorcycles must be equipped with footrests for all passengers (except those in a sidecar or an enclosed cab).

Anyone riding a motorcycle must wear approved protective headgear securely fastened to their head, and the operator must wear an approved eye-protective device over their eyes. (Motorcycle riders over 21 years of age are not required to wear protective headgear if they are insured for at least $10,000 against injuries that result from a crash while riding a motorcycle.) Legal requirements aside, smart riders use added protection. Leather jackets, pants, gloves, and boots keep cyclists warm and dry, and can help to prevent serious injury in the event of a collision or fall. Bright-colored clothing is better than darker colors: fluorescent clothing is best for daytime riding, while reflective gear should be worn at night.

Motorcycles are entitled to the full use of a lane of traffic, and no other motor vehicle may deprive a motorcycle of the full use of a lane. Motorcyclists may not overtake and pass in the same lane occupied by the vehicle being overtaken, and motorcyclists are prohibited from riding between lanes of traffic or between adjacent lines or rows of vehicles. Motorcycles may, however, be ridden up to two abreast in a single lane.6

**Vulnerable Road User Safety Trends**

The complete separation of unequal types of road users is, of course, the ideal solution to the hazards faced by vulnerable road users. Because this is not always possible, however, the practical solution most often involves separating unequal users as much as possible and reducing the speed of motor vehicles.

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FS 316.2085 – 316.211.
Adapting motor vehicles with collision-friendly fronts and, for trucks, with side-underrun protection can lessen the severity of injuries to vulnerable road users. Of course, many crashes can be avoided by adequately equipping vehicles with properly adjusted side- and rearview equipment so as to, as much as possible, limit blind spots (especially when turning right).

It is also important to the safety of vulnerable road users that infrastructure elements such as sidewalks and dedicated bicycle lanes/paths are properly engineered and maintained.\(^7\)

**Speed-Reducing Measures**

Reduced speeds allow drivers more time to scan the environment for hazards and greater reaction time/distance to avoid a conflict. Reduced speeds are also helpful to ensure a safe collision speed when impact with a vulnerable road user is unavoidable. In a crash between, for instance, a passenger vehicle and a cyclist or pedestrian, the survival rate of the latter decreases rapidly with an increase in the motor vehicle’s speed. Nearly all pedestrians survive a collision with the front of a car at a collision speed of 12 mph. When the collision speed is 25 mph, the survival rate is approximately 90%; at 50 mph, fewer than half the pedestrians survive; and at 62 mph, the survival rate dips to 10%. Engineers are encouraged to post lower speed limits, and even to use speed bumps and other speed-reducing measures, in areas that might be unsafe for vulnerable road users. And motorists are encouraged to slow down—regardless of any speed limits—when driving in the proximity of vulnerable road users.\(^8\)

**Bike Lanes and Merging with Cyclists**

While bicyclists have the same right to use the road as a motor vehicle, cyclists are encouraged to use a dedicated bike lane whenever possible. Still, a large percentage of motorist-bicycle crashes occur at intersections. Always assume that bicyclists are traveling straight unless they signal otherwise, and yield to them just as you would any other vehicle. Bicyclists often ride on sidewalks and trails, and may come from an unexpected direction; watch carefully before crossing these paths.

When turning right with a bike lane present, signal your turn and yield to any bicyclist in the bike lane before crossing the bike lane to enter a right-turn lane. If no right-turn lane is present, yield to any cyclist present in the bike lane and make your turn behind the bicyclist. Otherwise, merge into the bike lane before making your turn.\(^9\)

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\(^7\) Institute for Road Safety Research, “SWOV Fact Sheet: Vulnerable Road Users,” July 2012, p. 3 – 4 (http://www.swov.nl/rapport/Factsheets/UK/FS_Vulnerable_road_users.pdf; accessed September 19, 2014); speeds have been converted from System International measures and rounded to the nearest whole number.

\(^8\) ibid., p. 4.

Bike Box/Advanced Stop Lines

An advanced stop line, also referred to as an advanced stop box or bike box, is a system of road markings employed at signalized intersections to allow certain vehicle types a head start when the traffic signal changes from red to green. The markings include a green box on the roadway with a white bicycle symbol inside, and include a green bicycle lane approaching and leading from the box. There are two parallel stop lines at the intersection: the first, at which all traffic except for the specified users (usually bicyclists, but sometimes buses or motorcycles) must stop; and a second, closer to the intersection, to which only the specified users may proceed. Signage may inform road users of the meaning of the extra stop line. Separate signals may be provided for the specific traffic, but usually all vehicles use the same signals.

The primary goal of this set-up is to prevent, through enhanced visibility and awareness, collisions between motorists who are turning right and cyclists who are going straight. At a red light, cyclists are more visible to motorists because they are in front of them. At a green light, the bike lane through the intersection reminds motorists and cyclists to watch for one another.

When the traffic signal is yellow or red, motorists must stop behind the white stop line that is behind the bike box. Don't stop on top of or "in" the bike box; keep it clear for cyclists' use. A right-turn-on-red may not be made at these intersections. When the light turns green, motorists and cyclists may move through the intersection as usual, with cyclists proceeding first. Motorists turning right on the green should signal and watch for cyclists to the right, especially in the green bike lane in the intersection.

Cyclists enter the bike box from the approaching green bike lane, stopping before the crosswalk on a yellow or red traffic signal. When the light is green, cyclists proceed as usual, taking care to watch for right-turning motor vehicles.10